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CHROMOSOME NUMBERS IN NEOTROPICAL *ERYTHROXYLUM* (ERYTHROXYLACEAE)

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The genus *Erythroxylum* includes some 200 species, the great majority of which are found in the American tropics. Within this genus are found several economically important plants, most notably *E. Coca* Lam. and *E. novogranatense* (Morris) Hieron. These two closely related species native to South America are extensively cultivated as the sole source of the alkaloid cocaine. Numerous cultivars and local races of these species occur in the Amazon and Andes, the result of at least 6000 years of coca cultivation. The variation and evolution of coca under domestication has been little studied in recent years and little is known about the cytogenetics and breeding relationships of this important crop.

As part of a multidisciplinary project on coca, we have conducted a preliminary cytological study on *Erythroxylum* species. Until now, there have been no published chromosome counts with voucher specimens of any neotropical *Erythroxylum;* nor are any vouchered counts known for the cultivated species. Species of *Erythroxylum* are notoriously difficult to distinguish morphologically, and much confusion exists in the taxonomic placement of many species. It is therefore essential that herbarium vouchers accompany all chromosome studies and that chemical analyses carried out on the genus to insure present and future identifications.

Five chromosome counts of *Erythroxylum* species have been published in the past. These are summarized in Table One. Only one of these counts (*E. Kunthianum* Wall.) bears a voucher specimen. The correct identity of the two plants determined as *E. Coca* is especially open to question. Several

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related species, both wild and cultivated, are frequently misidentified as *E. Coca*.

Materials and Methods

Mitotic counts were made from root tip meristems from greenhouse reared plants, pretreated in 0.004 M 8-hydroxyquinoline at 15°C. for 3 hours (Tijo & Levan, 1950). Root tips were then rinsed in distilled water, stained 1/2 hour in 1% acetic orcein: 1 N HC1 (9:1) with gentle heating, and squashed in 45% acetic acid.

Meiotic studies were conducted with flower buds fixed and stored in Carnoy's solution (ethanol: acetic acid, 3:1). Tissue stored in Carnoy's for up to 4 years provided adequately preserved material for study. Microsporocytes were squashed and stained in acetocarmine. Photographs were taken with a Zeiss oil immersion lens under phase illumination. Herbarium vouchers are preserved at the Economic Herbarium of Oakes Ames (ECON).

Results and Discussion

Chromosome numbers are summarized in Table Two. All counts showed 2n = 24 or n = 12, in agreement with earlier published counts for *Erythroxylum*. It would seem that n = 12 is the base number for the genus. Some chromosomal irregularities, including chromosome bridges, were observed in microsporocytes of *E. Coca (Plowman 6165, 6183)*. A more detailed investigation of additional material will be necessary for a better understanding of these features. So far as is known, all the species investigated here appear to be normal, sexual species.

Cytological examination of preserved buds of *Erythroxylum havanense* Jacq. *(Plowman & Davis 3563)*, *E. Ulei* O.E. Schulz *(Plowman 6189)* and *E. areolatum* L. *(Kress s.n.)* proved unrewarding. The smallest buds (ca. 0.5 mm. diameter) showed pollen already formed. Furthermore, preserved material of these wild species was difficult to work with because of tissue hardness, preventing good squash-preparations. In the future, better results may be obtained by special pretreatment of buds or by examining root tips when material is available.

It is clear that much remains to be done in the cytology of *Erythroxylum*. The study of cytogenetics has been essential in determining the origin and evolution of numerous cultivated plants. *Erythroxylum* should be no exception. Of initial, primary importance is an investigation of karyotypes and chromosomal behavior in the main cultivated forms of *E. coca* and *E. novogranatense*, as well as in related wild species.

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TABLE ONE: PREVIOUSLY PUBLISHED CHROMOSOME NUMBERS IN *ERYTHROXYLUM*

SPECIES	CHROMOSOME NUMBER	LOCALITY AND VOUCHER	REFERENCE
E. Coca Lam.	2n = 24	Not given	Heitz (1929)
E. Coca Lam.	2n = 24	Not given	Janaki Ammal in Darlington & Janaki Ammal (1945)
E. emarginatum Thonn.	2n = 24	West Africa	Mangenot & Mangenot (1958, 1962)
E. Kunthianum Wall.	n = 12	India: Khasia and Jaintia Hills, Shillong. *Mehra & Khosla 1904* (PAN)	Mehra & Khosla (1969)
E. Mannii Oliv.	2n = 24	West Africa	Mangenot & Mangenot (1958, 1962)

TABLE TWO: NEW CHROMOSOME NUMBERS IN *ERYTHROXYLUM*

SPECIES	CHROMOSOME NUMBER	LOCALITY AND VOUCHER
E. Coca Lam.	n = 12	U.S.A.: cultivated, Cambridge, Massachusetts. *Plowman 6122* (Grown from seed collected in Peru: Dept. Ayacucho. San Francisco. *Plowman & Jacobs 4711*).
E. Coca Lam.	n = 12	U.S.A.: cultivated, Cambridge, Massachusetts. *Plowman 6165.* (Grown from seed collected in Peru: Dept. Ayacucho. San Francisco. *Plowman & Jacobs 4711*).
E. Coca Lam.	n = 12	U.S.A.: cultivated, Cambridge, Massachusetts. *Plowman 6183.* (Grown from cuttings collected in Colombia: Dept. Vaupés. Río Kubiyú. *E.W. Davis* 20).
E. novogranatense (Morris) Hieron.	n = 12	Colombia: Dept. Cesar. Sierra Nevada de Santa marta. Sogrome. *Plowman & Davis 3685.*
E. novogranatense (Morris) Hieron.	n = 12	U.S.A.: cultivated, Cambridge, Massachusetts. *Plowman 6180.* (Grown from cuttings collected in Colombia: Dept. Huila. San Agustín. *Plowman & Davis 4152*).
E. novogranatense (Morris) Hieron.	2n = 24	U.S.A.: cultivated, Cambridge, Massachusetts. *Plowman 6275.* (Grown from seed collected at Fairchild Tropical Garden, Miami, Florida. *Plowman 3500*).
E. novogranatense var. *truxillense* (Rusby) E. Machado	2n = 24	U.S.A.: cultivated, Cambridge, Massachusetts. *Plowman 6250.* (Grown from seed collected in Peru: Dept. La Libertad. Simbal. *Plowman 5620*)
E. orinocense HBK.	2n = 24	Colombia: Dept. Cesar: Sierra Nevada de Santa Marta. Atánquez. *Plowman & Davis 3600.*

Explanation of Plate

Plate 17. Fig. 1-6. 1. Microsporocyte of *Erythroxylum Coca, Plowman 6183.* X 1000.

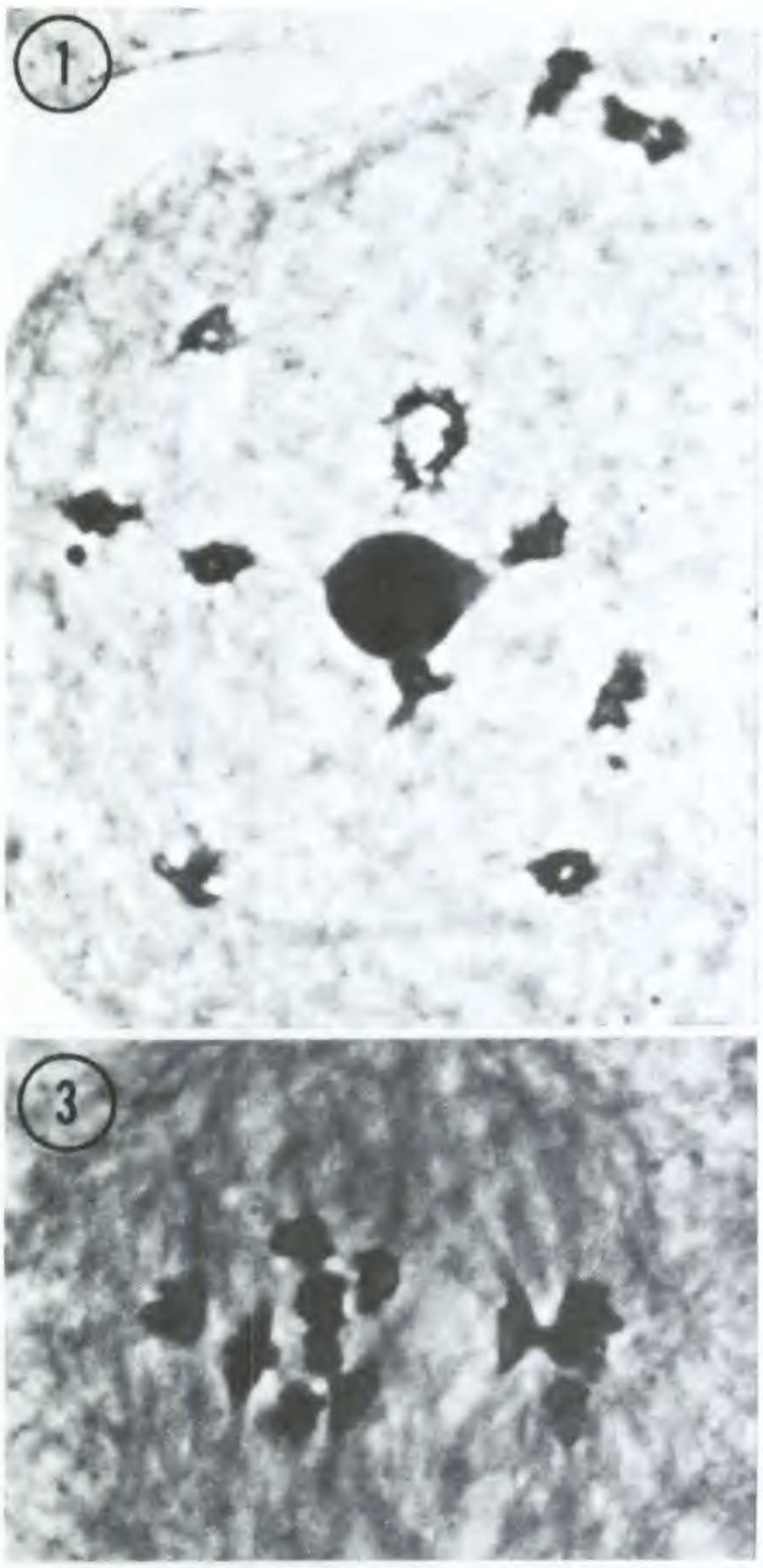
2. Microsporocyte of *Erythroxylum Coca, Plowman 6165.* X 1000.

3. Microsporocyte of *Erythroxylum novogranatense, Plowman 3685.* X 1300.

4. Microsporocyte of *Erythroxylum novogranatense, Plowman 6180.* X 1300.

5. Root tip cell of *Erythroxylum novogranatense, Plowman 6275.* X 2800.

6. Root tip cell of *Erythroxylum novogranatense* var. *truxillense, Plowman 6250.* X 2900.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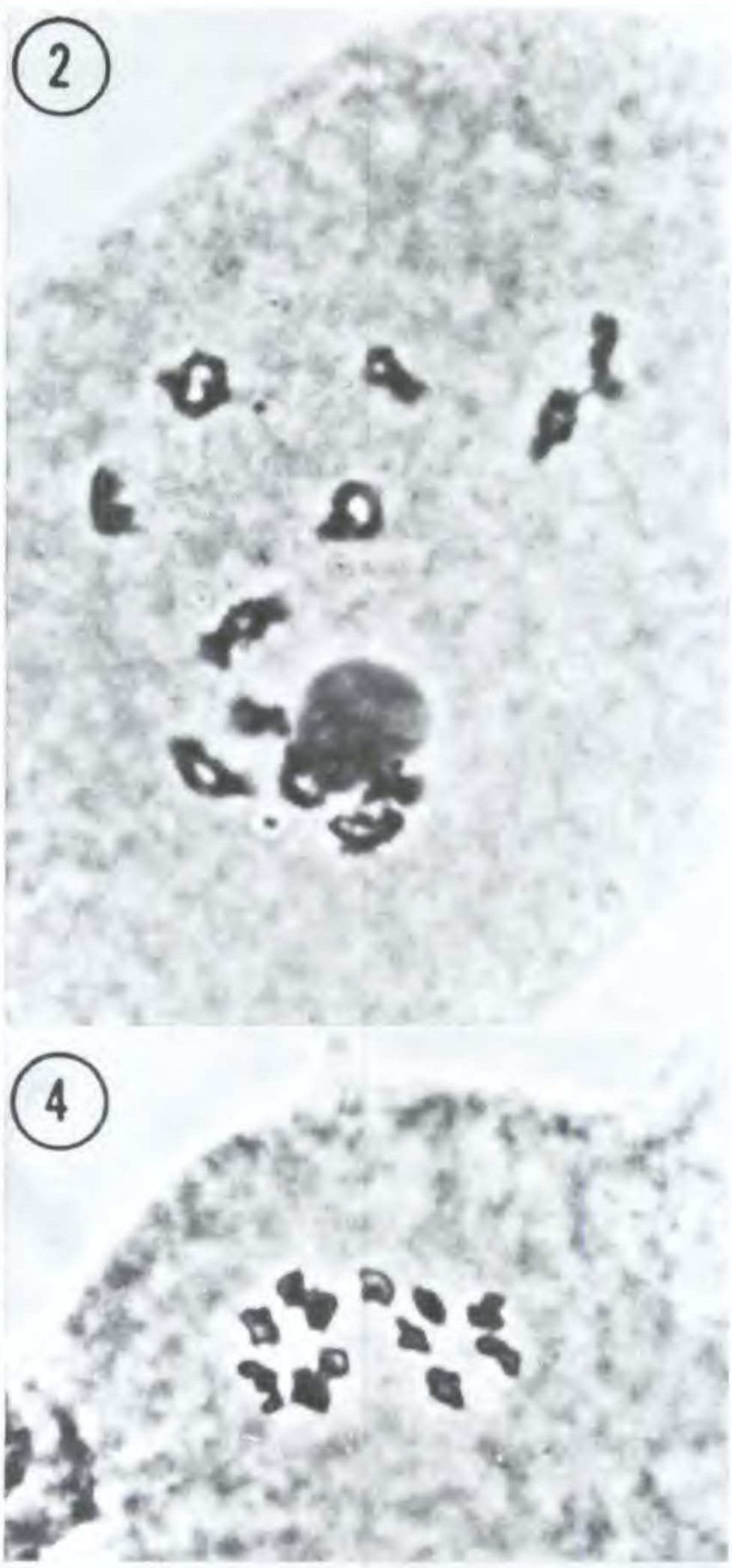
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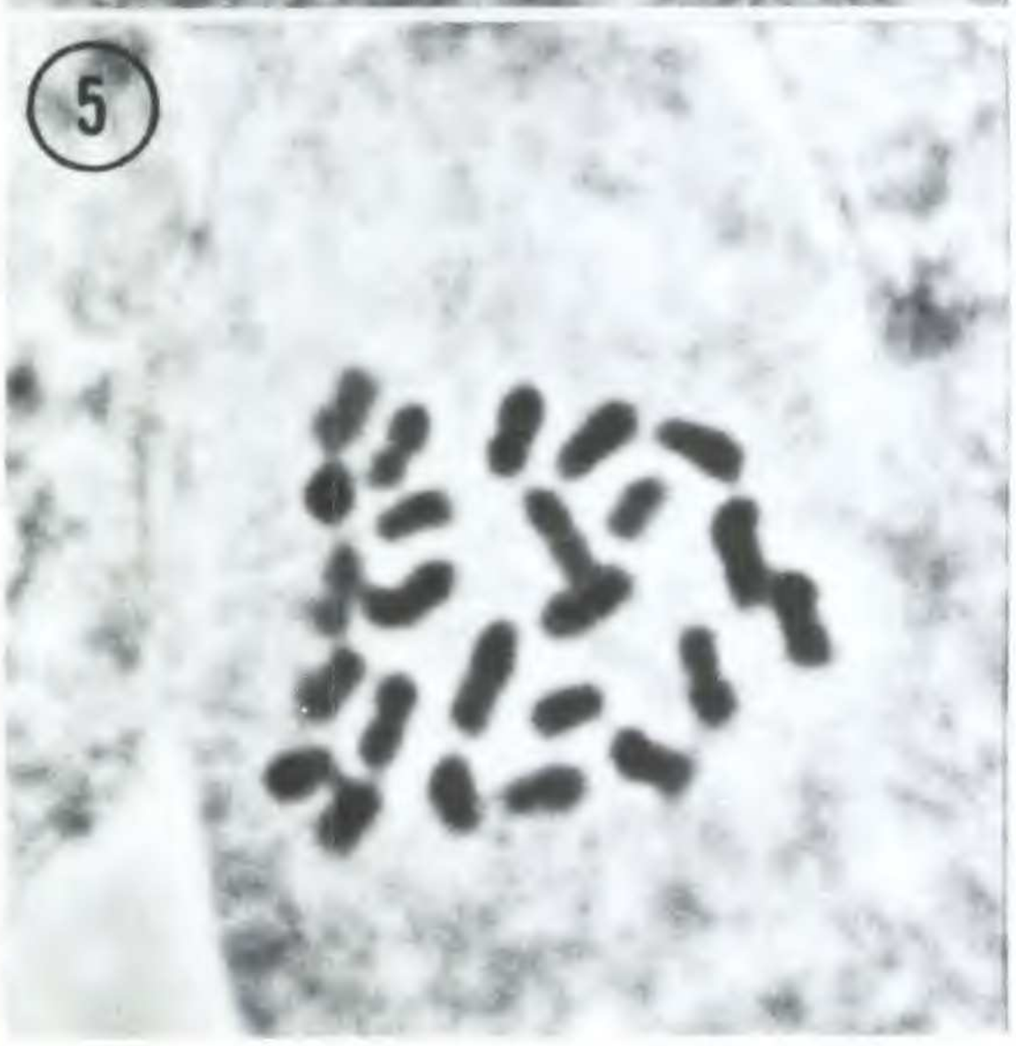
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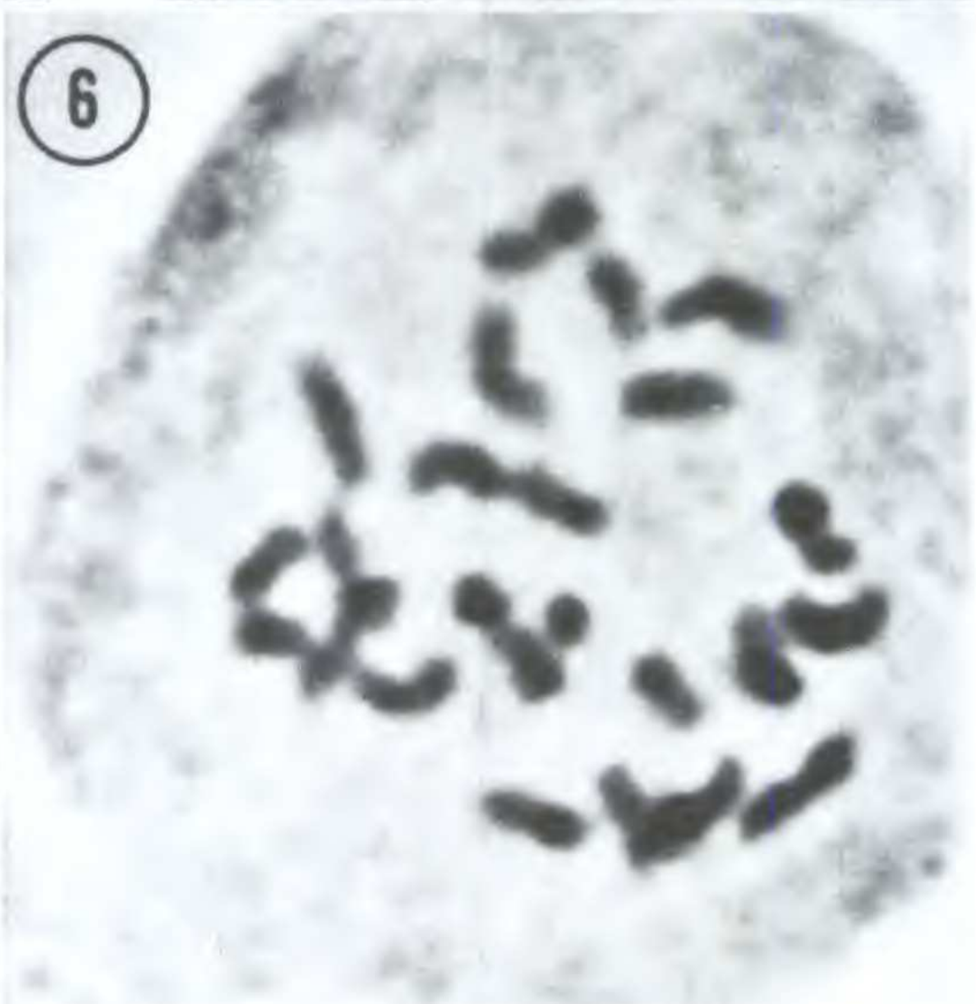
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